AMERICAN JOURNAL OF PHARMACY

and

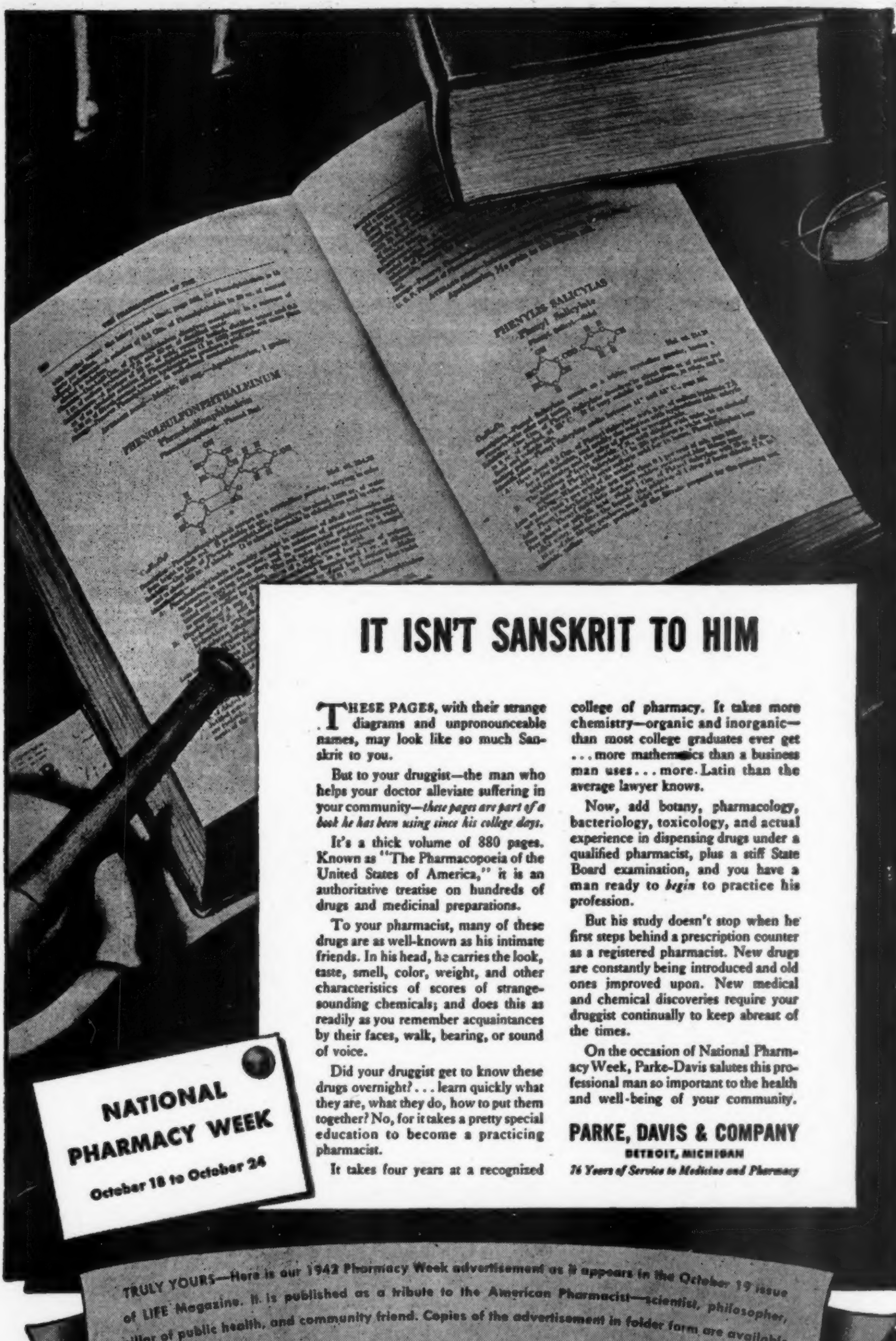
THE SCIENCES SUPPORTING PUBLIC HEALTH

SINCE 1825

MODERN PHARMACEUTICAL EDUCATION

OCTOBER
1942

"Healing River" by Everett Henry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E D I T O R I A L

THE AMERICAN FOUNDATION FOR PHARMACEUTICAL EDUCATION

THE American Foundation for Pharmaceutical Education was formally organized on October 1, 1942; this rather unique organization in the field of pharmacy having been incorporated under the laws of New York on August 17th.

Its membership includes men who are outstanding in eleven key organizations in the field of pharmacy; colleges, boards, manufacturers, wholesalers, retailers and the A. Ph. A. The organization is set up for the purpose of receiving and administering funds to improve and broaden pharmaceutical education. This it will attempt to do by aiding and strengthening colleges of pharmacy. The program, as outlined by the board of directors, will be as follows:

(1) To help worthy colleges develop strong undergraduate programs.

(2) To support graduate work in colleges qualified to carry on such programs in a creditable manner.

(3) To encourage scientific research both as a necessary component of graduate work and as a special project.

(4) To render general and special help such as the maintenance of scholarship and loan funds for worthy students and the promotion of other projects.

Those who are engaged as pharmaceutical educators will watch this program with great interest and high hopes. Although its membership includes men closely identified with colleges of pharmacy, a somewhat larger group is connected with the manufacturing and distributive phases of pharmacy. This is in a sense as it should be since the need on the part of colleges for outside assistance is clearly established. The real issue is whether sufficient interest in the project can be aroused in the commercial and industrial fields involved to result in the accumulation of funds that can be administered as outlined above.

Colleges of pharmacy are indeed in a dilemma insofar as funds are concerned. The differential between what a student pays and the cost of what he receives in the way of education constantly increases, and quite properly so.

Much damage was done in years past with quick and easy education on a "pay as you go" basis. Too many pharmacists, and some of them poorly prepared, were turned loose on society. That is, fortunately, a thing of the past and modern pharmaceutical education, *if it can survive long enough,* will slowly but surely correct many of the evils which exist in pharmacy today.

Colleges, however, are faced with the necessity of obtaining, in constantly increasing amounts, funds to cover the differential between operating costs and student fees. This is done either through government aid, endowment, or beneficences on the part of those who through pharmacy have profited well, and in this way show their gratitude.

Endowment is a comfortable yet not altogether permanent backlog. Securities do lose value and investments, although originally sound, may suddenly become non-productive. Government aid is believed to be the only answer by many, and indeed it is the method used by most state universities. But in government aid there is the constant danger of political interference and to the true pedagogue this is more distasteful than poverty. There remain only those contributions given generously and without expectation of return by those who through pharmacy have profited most. Unfortunately, the number of men in pharmacy who have remembered their profession through their gifts is not a large one. We have some whose generosity has been most praiseworthy—but they are all to few. Too often entirely unrelated fields have reaped the profit which pharmacy so richly deserved.

The future of our system of free enterprise depends upon freedom in education which, in pharmacy at least, is measurably dependent upon whether those who have profited by this system want to see it continued, or completely socialized and made subject to governmental control.

Our best wishes for signal success to this new Foundation and for the future of all those who cherish personal and academic freedom above all else!

L. F. TICE.

THE COMPARATIVE PHARMACOGNOSY OF POTENTILLA ANSERINA L. AND POTENTILLA ARGENTEA L.

By H. W. Youngken, Jr., and E. B. Fischer

The following article is Part I of an abstract of a thesis presented to the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree Ph. D., awarded June, 1942. This part of the paper deals with the pharmacognostic differences between the Potentillas. Part II, which will appear in the next issue presents their comparative pharmacologic action on the isolated uterine strip of the guinea pig.

THE problem forming the subject of this paper has arisen from the recent reports found in the literature on the appearance of spurious quantities of the drug plant, *Potentilla Anserina* L. in the crude drug markets of the United States. One of the most common agents, according to Bliss and Youngken (1) erroneously mixed with *P. Anserina* L. has been the closely related species *Potentilla argentea* L. This admixture has been attributed to the existing confusion among some drug collectors who have thought *P. argentea* L. synonymous with *Argentina Anserina* (L) Rydb. since the latter name has been the American Botanical Code name used often by older American botanists for *P. Anserina* L. Fernald (2) has likewise recognized the possibility of wrongly classifying the two plants due to the confusion existing in their synonymy. The primary purpose of this study (Part I) has been then to obtain pharmacognostic characteristics from each by which one drug plant might be distinguished from the other whether it be in the entire, broken, or ground form.

Materials and Methods

More than 21 pounds (10 kilograms) of fresh *Potentilla Anserina* L. were collected in western Minnesota along the Minnesota River and approximately 12 pounds (6.7 kilograms) of fresh *P. argentea* L. were collected along the Mississippi River in Minneapolis, Minnesota. Both collections were authenticated by members of the Botany Department, University of Minnesota. Approximately 8 pounds of the entire drug parts of *P. Anserina* were obtained from three commercial sources within the United States. Five pounds of this material were known to be of European origin. No quantity of *P. argentea* L. could be obtained from a commercial source at the time.

External morphological comparisons were made of both species using material collected in the field and authentic herbarium speci-

mens. Histological comparisons were studied from sections of fresh and dried materials, some of which had been previously fixed and stained. Permanent slides were prepared of representative portions of both plants with the use of the Zirkle (3) N/butyl alcohol dehydration method, and paraffin imbedding. Among stains used were Heidenhains iron alum haematoxylon with safranin for permanent slides and anilin sulfate, chlorozinc iodide, 1 per cent. ferric chloride iodine T. S., and phloroglucin-HCl solutions for the examination of freshly cut sections.

In the preparation of powdered material a portion of the fresh drug following its collection was immediately allowed to air dry for a period of several weeks. When thoroughly dried a suitable quantity of the entire portions of both species and a quantity of *P. Anserina* L. from a European source were milled. A Wiley Num-

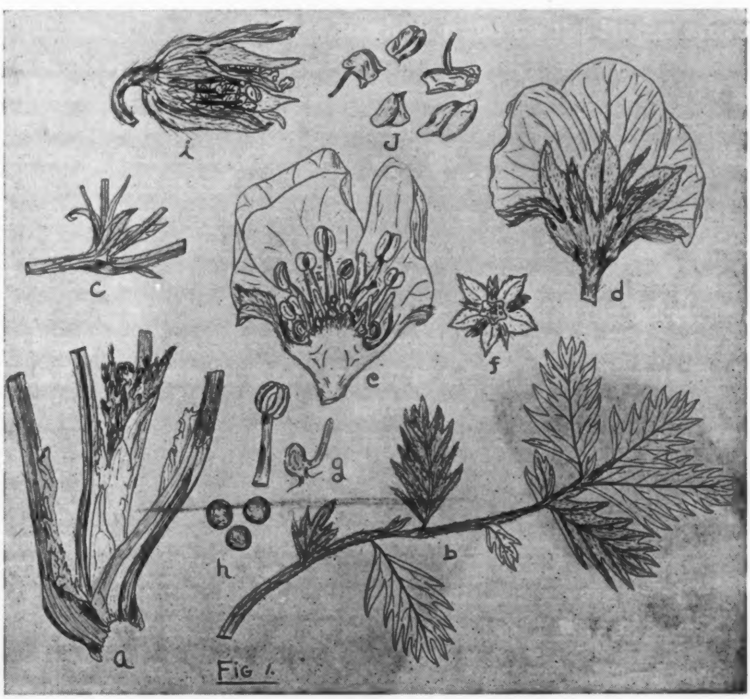

Plate Number 1. (*Potentilla Anserina* L.)
a Petiole bases, *b* a compound leaf, *c* node, *d* side view of the flower, *e* longitudinal section of the flower, *f* calyx whorl, *g* pistil, *h* pollen grains, *i* calyx cluster with achenes, *j* achenes.

ber 1 Electric Cutting Mill and Screen were used for the milling and sifting to obtain a uniform powder of Number 20 fineness. The use of a grinding type mill proved to be unsatisfactory in this work because of the constant matting and clogging of plant portions on the screen.

Experimental

Differences between the two drug plants were found to be numerous and to include differences in root, stem, leaf, flower, and fruit characters. The most outstanding comparative characters are as follows:

Root Structure: The root system of *P. Anserina* L. consists of short or long adventitious, fibrous, and filiform roots. (Plate 4.) Adventitious roots also descend from various regions of creeping runners or from upright basal stems. Upper portions of the fibrous roots near the crown are usually solid fleshy, 2 to 6 in number and lower portions are spongy tortuous and wrinkled. The root texture is characteristically fleshy to brownish corky with scattered abraded cork sloughing

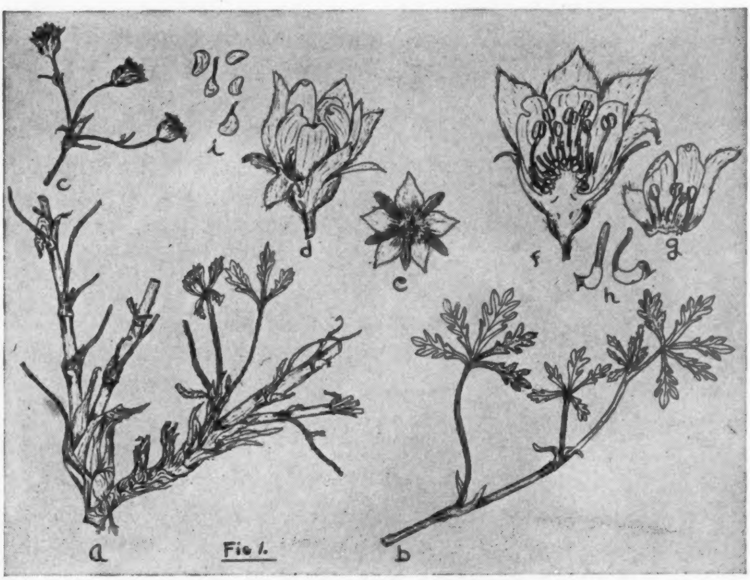

Plate Number 2. (*Potentilla argentea* L.)
a Basal and upper stems, *b* stems and leaves, *c* pedicels and calyx clusters, *d* side view of flower, *e* calyx whorl, *f, g* longitudinal section of flower, *h* pistils, *i* achenes.

off at irregular intervals. Root scars are numerous and slight longitudinal wrinkles and furrows are present everywhere. Annular marks and circular clefts are usually absent. These are present sometimes in regions of an occasional root twist or bend. Fracture is short, brittle, and uneven or incomplete. The fractured surface exhibits a whitish to brownish spongy cortical area and a light brown to gray

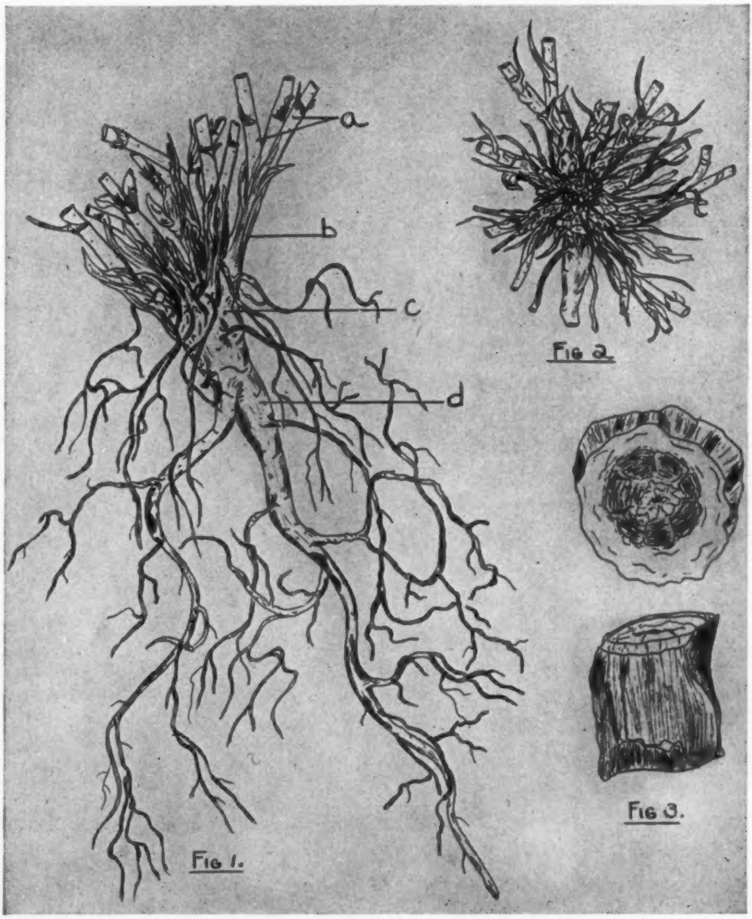

Plate Number 3. (*Potentilla argentea* L.) The root structure.
Fig. 1. *a* Basal stems, *b* scales, *c* crown, *d* main root.
Fig. 2. Top view of the root crown portion.
Fig. 3. Showing fractured surfaces of the dried root.

porous woody zone. The odor is sweet, not sternutatory; the taste is sweet to starchy becoming gradually astringent and bitter.

The root system of *P. argentea* L. consists of a primary conical root, rarely more than 15 cm. in length, with numerous tortuous and filiform lateral roots arising at varying levels. (Plate 3.) The entire root system is woody and solid and lacks the spongy nodose or swollen tuberous portions characterizing *P. Anserina* L. roots. The root texture is smooth, woody, and corky with occasional scaly borke sloughing off. Roots of *P. argentea* L. are seldom as deeply fissured when dried as those of *P. Anserina* L. Numerous root scars are scat-

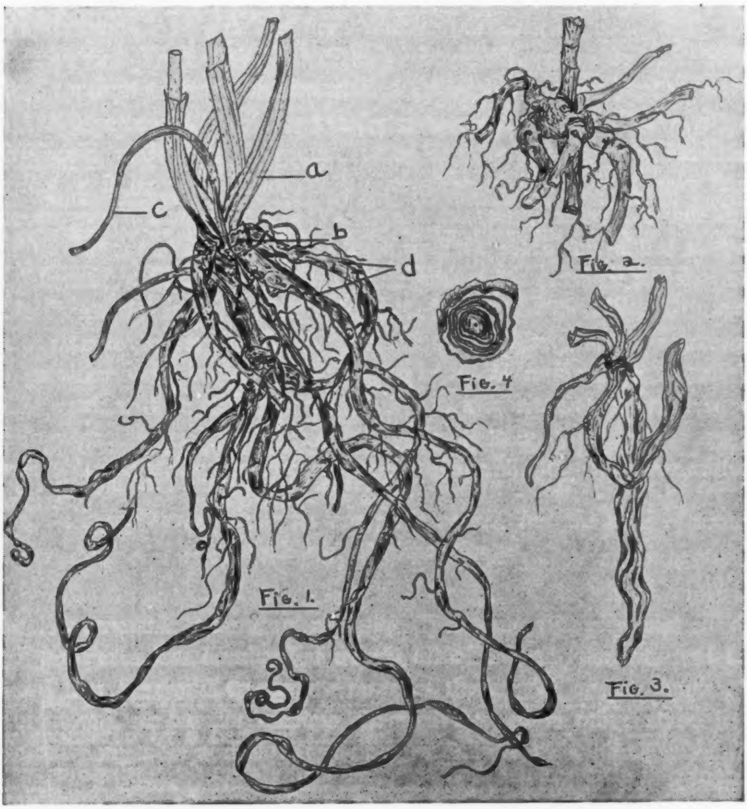

Plate Number 4. (*Potentilla Anserina* L.) The root structure.
Fig. 1. *a* Petiole bases, *b* crown portion, *c* runner, *d* adventitious roots.
Fig. 2. The crown portion of the root.
Fig. 3. Dried root and portion of leaves.
Fig. 4. Fractured surface of the root.

tered along the main and secondary roots. The fracture is uneven hard, smooth, and complete; the fractured surface exhibiting a solid ring of white to yellow woody tissue and a darker browing center of more or less soft collapsed tissue. The taste is slightly astringent but generally not as bitter or starchy as *P. Anserina* L.

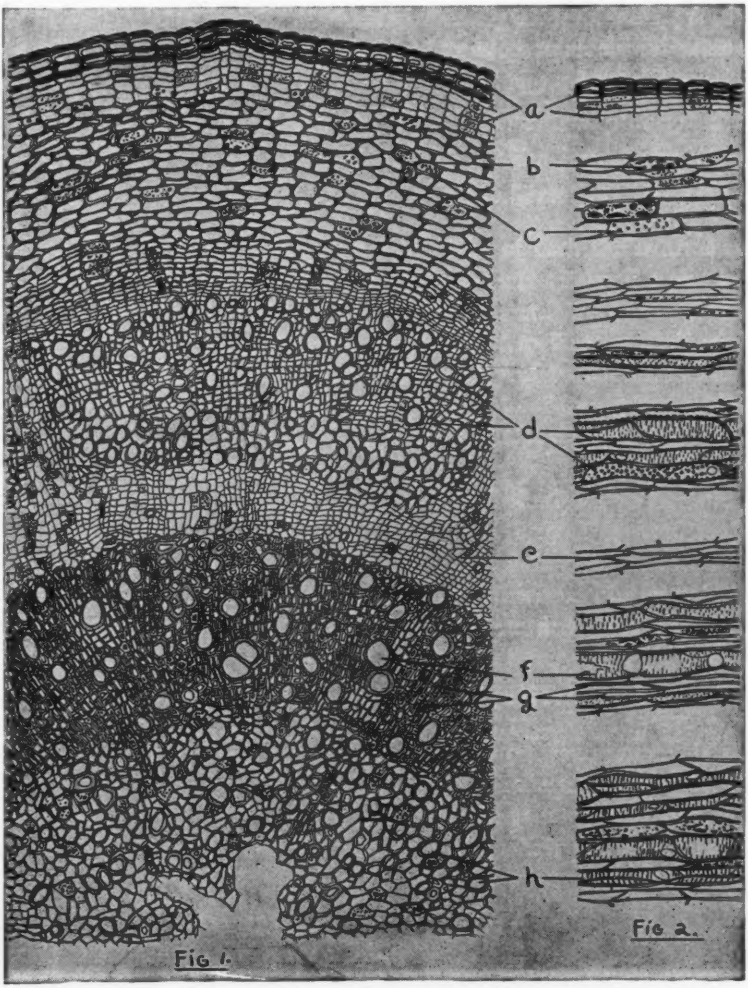

Plate Number 5. (*Potentilla argentea* L.) Cross and longitudinal sections of the root.

Figs. 1 and 2. *a* Outer cork, *b* cortex, *c* same as *b* with starch, *d*, *f*, *h* xylem vessels, *e* xylem parenchyma, *g* wood fiber.

Root Histology: Cross, radial, and tangential longitudinal sections were made through the entire root system of both *Potentilla* species. Typical sections of *P. Anserina* L. roots of secondary growth (Plate 6) show from periphery to center several layers of cork cells with scattered resin and tannin amorphous and globular masses, a sec-

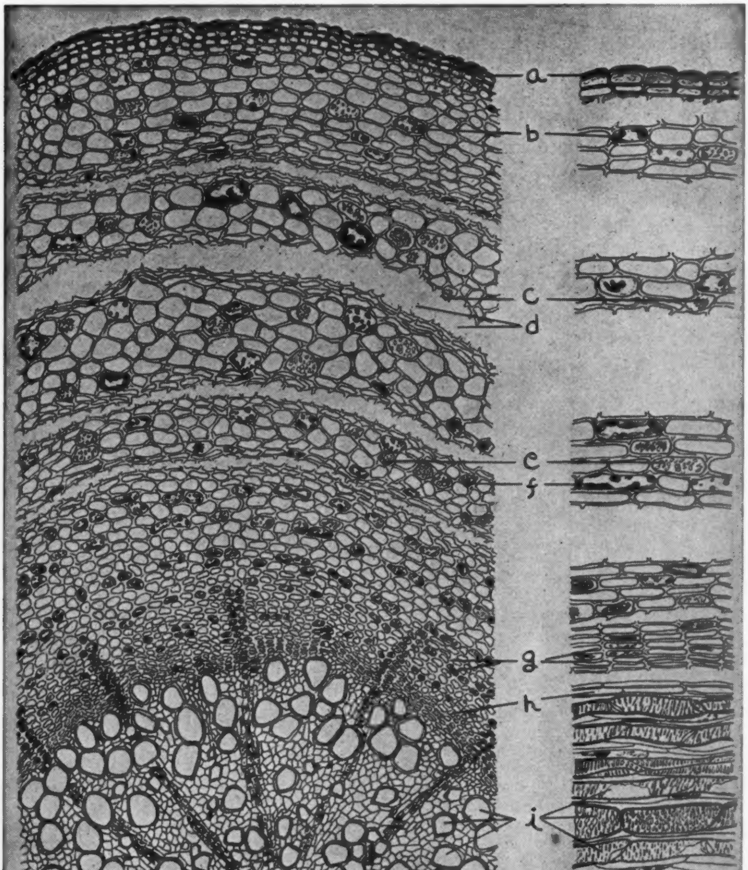

Plate Number 6. (*Potentilla Anserina* L.) Cross and longitudinal sections of the root.

Figs. 1 and 2. *a* Outer cortex region, *b* cortex cells with tannin and resin, *c* cortex parenchyma, *d* intercellular space, *e* rosette aggregate crystals of calcium oxalate, *f* same as *b*, *g* pericycle, *h* phloem, *i* xylem vessels, *j* xylem parenchyma.

ondary cortex with characteristic intercellular spaces and alternately compactly arranged and loosely arranged parenchyma cells. The latter zones in cross section of older growth exhibit as many as eight intercellular spaces formed in concentric patterns. Simple and 2 to 6 compound starch grains, rosette crystals of calcium oxalate up to 20 microns in diameter, and irregular amorphous and globular masses of tannin and resinous materials are present. The latter materials form in many interruptedly concentric rings as seen in transverse

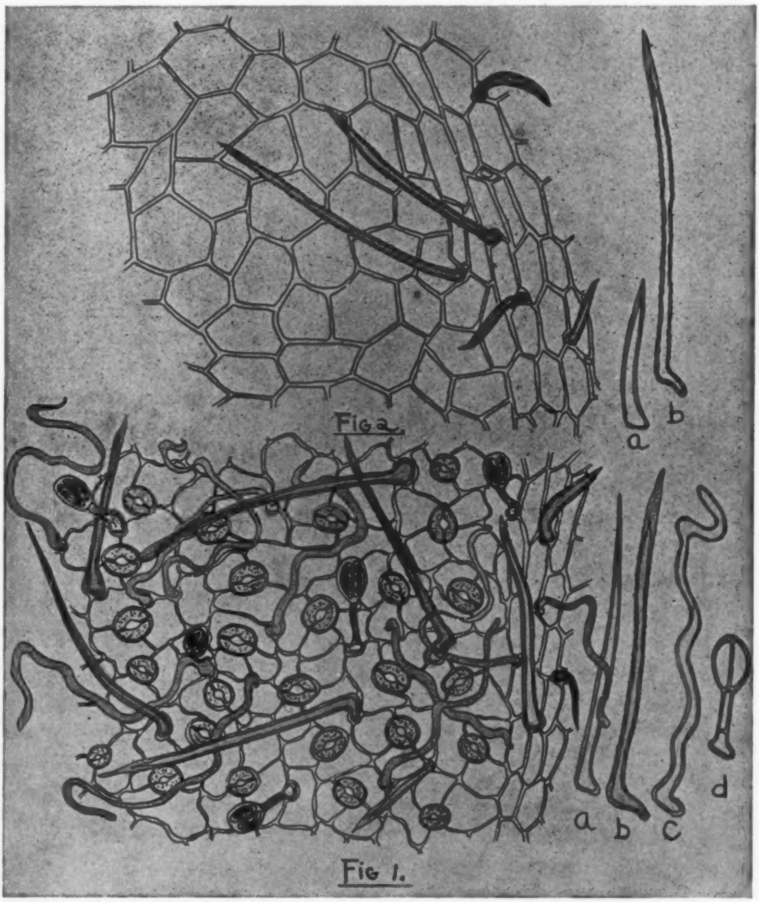

Plate Number 7. (*Potentilla argentea* L.) Surface section of leaflet.
Fig. 1. Lower epidermis: *a, b, c* non-glandular hairs, *d* glandular hairs.
Fig. 2. Upper epidermis: *a* and *b* non-glandular hairs.

section. No fibers or stone cells are visible in the cortex. Stelar tissues occupy less area than do the cortex cells. Resinous and

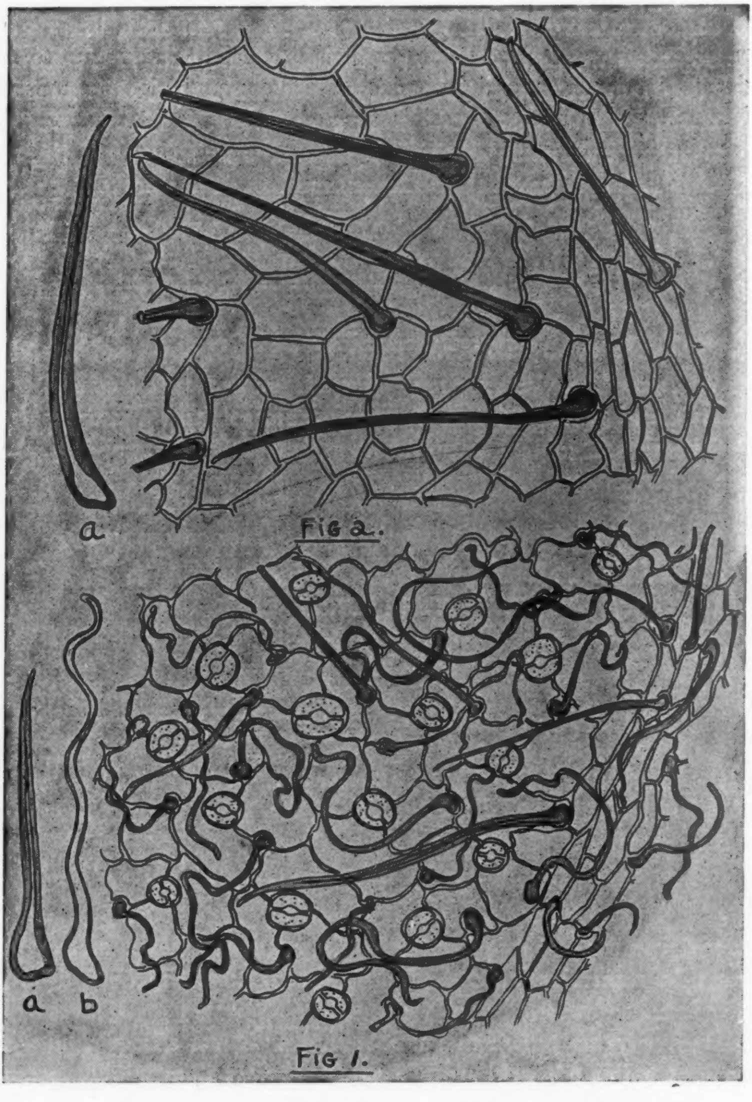

Plate Number 8. (*Potentilla Anserina* L.) Surface section of leaflet.
Fig. 1. Lower epidermis: *a*, *b* non-glandular hairs.
Fig. 2. Upper epidermis: *a* non-glandular hair.

tannin materials are scattered in the phloem and xylem. Xylem vessels are characteristically reticulate, reticulate-scalariform and bordered pitted with simple end wall perforations. Vessels are interspersed with xylem parenchyma, rays, and tracheids.

From periphery to center typical sections of *P. argentea* L. roots (Plate 5) exhibit cork tissues making up a thicker area than in *P. Anserina* L. roots, a cortex with compactly arranged parenchyma predominant and an absence of intercellular spaces which completely circle the cortex. Resinous and tannin deposits are diffusely scattered throughout the cortex and do not form in concentric rings as in *P. Anserina* L. roots. Starch grains are simple irregularly elliptical and 2 to 8 compound. Single grains measure up to 10 microns in

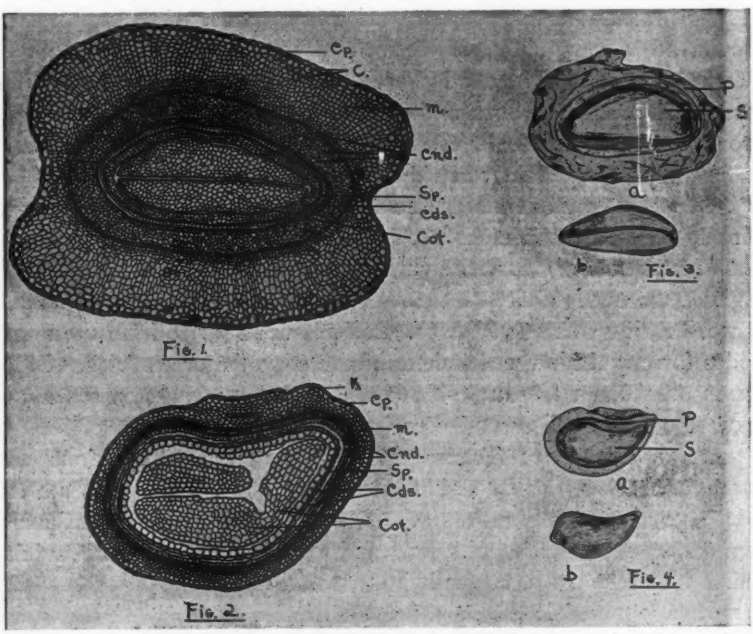

Plate Number 9. (*Potentilla Anserina* L. and *Potentilla argentea* L.)
Achene histology.

Fig. 1. *P. Anserina L.* achene cross section: *Ep* epidermis, *c* cork cells, *m* mesocarp, *end* endocarp, *Sp* spermoderm, *Eds* endosperm, *cot* cotyledon.

Fig. 2. *P. argentea* L. achene cross section: *K* keel, *Ep* epidermis, *m* mesocarp, *end* endocarp, *Sp* spermoderm, *Eds* endosperm, *cot* cotyledon.

Achene structures.

Fig. 3. *P. Anserina* L. *a* parts of achene: *P* pericarp, *S* seed, *b* a seed.

Fig. 4. *P. argentea* L. *a* parts of an achene: *P* pericarp, *S* seed, *b* a seed.

diameter. Rosette aggregate crystals of calcium oxalate measure up to 30 microns in diameter. The stelar tissues occupy most of the root cylinder and there is therefore less herbaceous cortical tissue than in *P. Anserina* L. roots of similar growth. Secondary xylem forms an inner and outer band of lignified vessels and wood fibers which give the section a "ringed" effect. Xylem vessels are characteristically scalariform, reticulate, and bordered pitted with simple end wall perforations. Wood fibers in longitudinal view are long with tapering ends and lignified walls.

Stem Structure: Stems of *P. Anserina* L. are creeping and tortuous, stoloniferous, and flower-bearing. (Plate 1.) Stoloniferous stems (runners) arise from a crown and are generally bristly pubescent to subglabrous. These measure up to 2.5 mm. in diameter. Flower-bearing stems (pedicels) arise from nodes of the runners or crown, are silvery silky pubescent, and measure up to 2.5 mm. in diameter. A single flower is borne at the apex. Stem and petiole fracture is complete, short, and weak exhibiting a yellowish-brown to brown fractured surface. The odor is indistinct and the taste sweet at first, becoming slightly astringent.

P. argentea L. stems are closely arranged toward the base and densely covered with numerous, dry scaly, brown-black, linear stipule remains. (Plate 2.) Lower stems have numerous node and internode regions, the nodes giving rise early to numerous branching stems and flower-bearing stems (pedicels). Pedicels which arise from the upper nodes form multiflowered indeterminate corymbs or panicles. Older stems are brown to purple-black and glabrous; younger stems are brown to green-yellow and occasionally sparsely pubescent.

Stem Histology: Transverse and longitudinal sections cut through *P. Anserina* L. stoloniferous and flower-bearing stems exhibit characteristically an outermost layer of suberose to occasionally lignified epidermal cells with long and curled uniseriate nonglandular hairs, 1 to 2 layers of larger hypodermal cells with resin and tannin, a narrow zone of loosely arranged cortical cells, and a large stelar region with innermost pith parenchyma. The stele is surrounded by 1 to 2 layers of brown endodermis and within this layer are pericyclic fibers of from 4 to 7 cells in width. Resin and tannin masses are prevalent in the stele. Xylem vessels are scalariform, spiral, and bordered pitted with simple end wall perforations. Woodfibers are generally not numerous.

Typical *P. argentea* L. stem histology exhibits from periphery to center an outermost epidermal layer of thick-walled isodiametric non-lignified cells. In the pedicel region numerous long, curling to jagged-edged non-lignified non-glandular and glandular hairs are present. The hypodermal cells within are generally large and slightly lignified in basal stems. Immediately within in smaller stems is a narrow zone of compactly arranged cortex cells each of which contains a resinous deposit in the form of a ring. This deposit surrounds the inner cell wall and renders a false fibrous appearance to each cell. The stele generally makes up the largest portion of the stem and consists of an outermost band of pericyclic fibers 5 to 8 rows wide. These fibers have thicker walls and narrower lumina than similar fibers of *P. Anserina* L. stems. Vessel elements within the stele are generally simple, bordered, and reticulately pitted. Wood fibers in this region are more numerous. Many xylem and phloem cells contain resin and tannin deposits. Pith cells which make up the largest area of the stele are slightly lignified outermost and those within contain starch and aggregates of calcium oxalate crystals.

Leaf Structure: P. Anserina L. leaves are mostly compound and consist of glabrous or pubescent petioles with oppositely and alternately borne leaflets. (Plate 1.) Larger leaflets measure up to 6 cm. in length are oblong-ovate to linear ovate with dentate somewhat ciliated margins. Most are oblique at the base and obtusely rounded at the apex. Venation is pinnate-reticulate and impressed on the upper surfaces; upraised with long appressed or raised silvery silky hairs on the lower surface. Primary veins or nerves extend to the leaf margins. Leaflet pubescence is of two main types, tomentose silvery-silky beneath and glabrous above, or tomentose silvery-silky beneath and silvery-silky above. Both types may be found on the same plant or on plants growing in the same habit.

P. argentea L. leaves are digitately compound and borne on long and short silvery-silky pubescent petioles. (Plate 2.) Leaflets are cuneate to obovate with pinnately divided margins and measure up to 2 cm. in length. Margins are not ciliated but revolute underneath and the leaflet base is tapering to cuneate rather than oblique as in *P. Anserina* L. Venation is pinnate-reticulate, not impressed on the upper surfaces. Veins frequently fail to extend to the leaf margins. Leaflet pubescence is of one main type, tomentose silvery-silky beneath and glabrous above.

Leaf Histology: Transverse and longitudinal sections of *P. Anserina* L. petioles exhibit cellular arrangement similar to that of the stems. However, from 3 to 6 open collateral bundles may be seen widely separated in the cortex regions. Each stelar group is usually surrounded by a conspicuous endodermis with the latter cells possessing many tannin and resinous materials. Generally toward the center of the petiole two to five large empty spaces may be found. Each space is lined with collapsed thin-walled cells. *P. Anserina* L. petiole segments which possess this type histology are invariably abundant in samples of crude drug material.

Sections made through the lamina portion of representative leaflets of *P. Anserina* L. are characterized by the presence of large amounts of resinous and tannin materials deposited in the epidermal cells and mesophyll region. Large rosette aggregates of calcium oxalate crystals are visible in the columnar palisade parenchyma cells. Hairs arising from the upper epidermis are non-glandular, straight, rarely curved, with thick cutinized walls and narrow lumina. (Plate 8.) Hairs arising from the lower epidermis are of two types, non-lignified, long winding tortuous, with large lumina and narrow walls and non-glandular short and straight with narrow lumina and thicker walls. (Plate 8.) Present in the mid-vein section of the leaflet are collenchyma cells, 1 to 3 vascular bundles and cortex cells with a large amount of calcium oxalate crystals, tannin and resin deposits.

Transverse, longitudinal, and surface sections of *P. Argentea* L. leaves exhibit the following histological characters differing from those of *P. Anserina* L. leaves: Leaf petioles are largely woody and rarely as conspicuous as those of *P. Anserina* L. Cells of the epidermal leaflet regions contain much less resinous and tannin materials and most of the epidermal cells are entirely devoid of these deposits. Palisade cells and mesophyll parenchyma cells are generally smaller than those of *P. Anserina* L. leaflets. Aggregate crystals of calcium oxalate present are correspondingly small and measure up to 20 microns in diameter. Surface sections of the leaflets (Plate 7) exhibit four types of diagnostic hairs, long winding tortuous non-glandular hairs with wide lumen and thin cutinized walls, long straight non-glandular hairs with thick jagged walls and narrow lumina, short bristly non-glandular hairs with cutinized walls, and short glandular hairs with uniseriate stalks and a 2-celled globular head. The latter are conspicuously brown and easily discernible in samples of *P. Anserina* L. mixed with *P. argentea.* In sections made

through the mid-vein portions of *P. argentea* leaflets collenchymatous and fibrous tissues are present along with resin, tannin, and calcium oxalate deposits.

Flower Structure: The more diagnostic characters from the flower portions of both species (Plates 1 and 2) of use in the identification of material are as follows: Flowers of *P. Anserina* L. are borne solitarily; those of *P. argentea* L. are formed in panicles or corymbs. Flowers of *P. Anserina* L. possess five yellowish to orange petals each of which is usually longer than the outer calyx whorl; flowers of *P. argentea* L. are smaller and yellow with the calyx whorl often as long as the five petals within. Petals of *P. argentea* L. flowers are frequently absent as they drop off readily at the time of drug collection. Pollen grains of *P. Anserina* L. flowers are round and smooth with irregular internal markings. Grains measure up to 23 microns in diameter. Pollen grains of *P. argentea* L. are elliptical to triangular with smooth convex and concave surfaces. These measure up to 28 microns in longest diameter.

Fruit Structure: P. Anserina L. achenes are light brown to chocolate brown, round, sometimes angular or lenticular or ovate, and vary in size from less than 1 mm. to 3 mm. in diameter. Many have longitudinal markings or a large furrow which divides the achene wall into two lobes. (Plate 9.)

Achenes of *P. argentea* L. are light brown to yellow-brown and characteristically pear-shaped with a prominent keel extending from one side. Each achene possesses brown striation lines or color marks. Fruits rarely measure more than 1 mm. in diameter; most are uniform in size. No grooved markings or impressions are visible.

The seeds of both *Potentilla* species are more or less pear-haped and uniform in size; those of *P. Anserina* L. are larger than those of *P. argentea* L. (Plate 9.)

Histology of the Fruit (Plate 9): Cross sections made through the entire fruit of *P. Anserina* L. exhibit from periphery to center layers of corky epicarp cells, a broad mesocarp zone, some cells of which are lignified, and an inner endocarp region of three layers of lignified and fibrous cells. The outermost endocarp layer possesses thick-walled lignified cells each of which contains a single monoclinic prism of calcium oxalate. Inner from these cells are several rows of compactly arranged lignified sclerenchyma fibers and cross cells. Spermoderm cells of the seed are lignified and more or less square with beaded walls. These cells are not attached to the fruit wall. The endosperm

region is small and surrounds a larger cotyledonary region within. Cells of these regions are more or less isodiametric and polygonal and contain aleurone grains and some fixed oil.

Fruits of *P. argentea* L. in cross section consist of an outer epicarp layer of cutinized, rarely suberized, cells; a narrow mesocarp zone with no lignified cells, and generally less resin and tannin deposits; and an endocarp zone of lignified sclerenchyma fibers and cross cells. Monoclinic prisms of calcium oxalate are present in outer cells of this region. The presence of a keel in cross section often characterizes these sections. Tissues of the seed include a spermoderm layer of isodiametric cells which contain scattered brown pigments, a small endosperm and a larger cotyledonary region. The embryo region of *P. argentea* L. is characteristically curved and divided with often one cotyledon exceeding the other in size.

Examination of Powdered Material: Several fragments of the tissue elements already described may be visible in an examination of the powdered drug. Miscroscopically those fragments of diagnostic value in identifying each species are as follows: *Powdered P. Anserina* L., numerous hairs from the petioles and leaves and these are of two main types, tortuous non-glandular with large lumen and narrow smooth cutinized walls, and short straight non-glandular hairs with narrow lumen and thicker smooth cutinized cells walls; numerous fragments of spiral, scalariform, simple, and bordered pitted vessels, some elements measuring up to 100 microns in diameter; pericyclic fibers and sclerenchyma fibers from the stem and achene portions; lignified thin-walled cells with reticulate markings, a few simple and 2 to 6 compound starch grains, rosette aggregates of calcium oxalate crystals, and abundant deposits of resin and tannin masses.

Powdered P. argentea L.: Numerous hairs from the petioles and leaves and of four main types, tortuous and long non-glandular hairs with wide lumens and thin smooth cutinized walls, long straight non-glandular hairs with thick jagged (serrate) walls and narrower lumina, bristly short non-glandular hairs with smooth walls, and characteristic short and 2-celled globular headed glandular hairs with a uniseriate 2 to 4 cell stalk. Vessel elements rarely exceed 70 microns in diameter and consist mostly of lignified bordered, scalariform, spiral, and reticulate pitted cells. Tracheids, wood fibers, and sclerenchyma fibers from the stem and achene portions are more abundant than in powdered *P. Anserina* L. Mesocarp cells from the achene are generally not lignified as in *P. Anserina* L. achenes.

Starch grains measure up to 10 microns and are 2 to 8 compound. Rosette aggregates of calcium oxalate crystals and resin and tannin deposits closely resemble those found in *P. Anserina* L. but are generally not as abundant.

Ash Determination: The total ash and acid-insoluble ash of representative portions of powdered *P. Anserina* L. and *P. argentea* L. were determined using the U. S. P. XI (4) methods. *P. Anserina* L. showed an average from several samples of 3.0 per cent. total ash and 1.3 per cent. to 2.6 per cent. acid-insoluble ash; *P. argentea* L. samples yielded an average of 2.6 per cent. of total ash and 1.0 per cent. to 1.3 per cent. acid-insoluble ash. Acid soluble ash averaged for *P. Anserina* L. 0.38 per cent.; and for *P. argentea* L. 0.71 per cent.

Volatile Oil Determinations: Volatile oil determinations made on representative portions of eight samples of powdered *P. Anserina* L. using the Clevenger (5) method of steam distillation showed an average yield of 0.28 per cent. volatile oil. Similar determinations using eight samples of powdered *P. argentea* L. yielded an average of 0.24 per cent. volatile oil.

Summary

A comparative examination of the pharmacognosy of *Potentilla Anserina* L. and *P. argentea* L. has been made. This study has established type descriptions and illustrations of the external and histological elements by which drugs of both plants may be identified whether they occur in the entire, broken, or ground form.

Differences between the external and histological structures of the two drug plants are numerous and include those in root, stem, leaf, flower, and fruit characters.

Histological elements of use in the detection of powdered *P. Anserina* L. mixed with powdered *P. argentea* L. have been described. Of these, three types of non-glandular hairs and one type of glandular hair present in powdered *P. argentea* L. were found to be reliable agents by which the latter drug plant might be detected.

Percentage yield of ash, acid-insoluble ash, acid soluble ash, and volatile oil were made to augment the pharmacognostic comparison. These were found to be comparatively equal for both drug plants.

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MODERN ALCHEMY

By Donald P. LeGalley

The following is based on a Popular Science Lecture delivered by the author at the Philadelphia College of Pharmacy and Science. Those not familiar with the modern concept of atomic structure, radio-activity and atomic transmutations, will find in Dr. LeGalley's article a clear picture of these phenomena in easily understandable language.

THE dream of the old Alchemist was to transform Lead into Gold. He used acids and alkalis, he boiled and distilled, he ground and mixed, he did everything in his power and knowledge to achieve this atomic transmutation—but without success. The reason? Because he did not know enough about the structure of matter. He did not have the knowledge we have today about such things as crystal structure, molecules, atoms, protons, neutrons, and electrons. Knowledge about these things has come slowly, and in most cases only after years of painstaking research. This is true chiefly because an atom or a molecule is so very, very small that it is difficult to learn what its secrets are, and what its habits are. In order to show just how small a molecule is let us consider this proposition.

Job of Counting Number of Molecules in One Cubic Centimeter of Water

Suppose you had the job of counting the number of molecules in one cubic centimeter of water, that is about one-half of a thimble full. There are 33×10^{21} molecules in this small volume. This number is 33 with 21 zeros after it, something larger than the national debt, if you can imagine that. In order to do this job, let us suppose that you had the help all of the men, women and children in the world, about 1.7 billion of them. Also let us suppose that the molecules could be counted like golf balls, or ping-pong balls, and that each person could count them at a rate of 4 per second, which is a rather fast rate. If all of these people worked 24 hours per day, 365 days per year on this job, without taking time out to sleep, eat or to do anything else, how long do you think it would take them to finish this task? The answer is 154,000 years. In other words, if your group of helpers had started this job at the time the Egyptians were building

the Pyramids 5,000 years ago, you would have counted just one-thirtieth of the molecules in this little cubic centimeter of water up to the present time.

The Modern Alchemist

The fact is that within the last fifty years scientists have been able to find out a great deal about molecules, atoms, and electrons. In the last ten years, or since 1932, physicists have gained enough knowledge about the fundamental structure of the nucleus of the atom and have been able to construct machines powerful enough not only to transmute Lead into Gold, but to transmute many of the other elements as well. For this reason we call him the Modern Alchemist. It is true that he has not been able to transmute very large quantities, but large enough for research work, and large enough to prove that it can be done.

Within the last few years, physicists with the aid of such powerful instruments as the cyclotron, the high-voltage generator and with radioactive sources has transmuted many of the other elements besides Lead; in fact, he has succeeded in converting nearly every one of the ninety-two known elements into one of its neighbors in the periodic table. For example, it is an everyday experience now to change Carbon into Nitrogen, Sodium into Magnesium, Phosphorus into Sulphur, Aluminum into Sodium, and dozens of other reactions which might be mentioned. So that we might say that the dream of the old alchemist has finally come true, and it has come true in a far different way, and on a much larger scale than he ever dreamed of. It has come true, chiefly because of painstaking research on the part of many scientists the world over into the secrets of nature about such tiny things as molecules, atoms and electrons.

How Do Scientists Gain Their Knowledge of Atomic Structure?

The question might be raised how do scientists gain their knowledge about such tiny quantities as molecules, atoms and electrons, if they are too small to be seen under even the most powerful microscope, and if it takes billions of them to make up a single drop? The answer is that the physicist has been able to develop tools and techniques which have enabled him to explore down among these tiny quantities and learn the laws which govern molecular and atomic

structure. He has such tools as the Spectroscope, the X-ray and particles shot off from Radioactive sources to help him. With the aid of these, and mathematic tools, he has explored the region of atomic domain, and today we know that every molecule is made up of atoms, that every atom is made up of two main parts, the nucleus and an outer swarm of electrons. The nucleus carries most of the mass of the atom, as well as a positive charge equal to the atomic number of the element. The nucleus acts as the center of the atomic system, just like the sun is the center of our solar system.

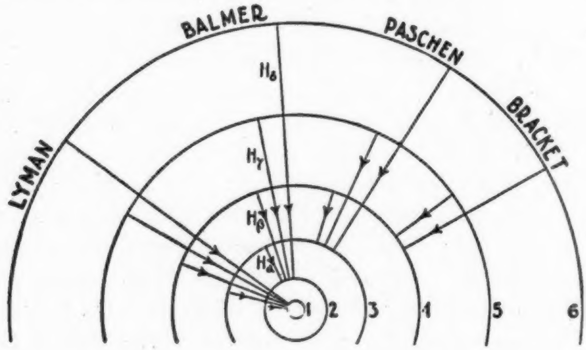

Fig. 461. Atomic Structure.

Around the nucleus there are tiny electrons revolving in certain prescribed orbits, just like the planets, such as the Earth, Mars, Venus, Jupiter, etc., revolve about the sun in certain prescribed orbits. Each atom has as many electrons revolving around the nucleus as its atomic number. Thus Hydrogen, which is No. 1 in the periodic table, has in its satisfied state one electron revolving in its innermost orbit. If Hydrogen becomes excited, as it does when it is placed in a very high potential, or in a very hot flame, then the electron may go to some other orbit such as No. 2, 3, 4, 5, or 6, as shown in Fig. 461. Oxygen, which is No. 8 in the periodic table, has 8 electrons, 2 of them in the first orbit and 6 in the second orbit. Copper, which is No. 29, has 29 electrons, and so on up to Uranium, which is No. 92 and has 92 electrons.

For every electron revolving around the nucleus there must be an equal number of positive charges on the nucleus, so as to make the atom electrically neutral. And for every positive charge added to the nucleus there must be added a proton which carries this positive

charge. This means that the mass of the atom has been increased by a number equal to the number of protons and the number of neutrons in the nucleus. For example, Hydrogen, which is No. 1 in the periodic table, has 1 proton in the nucleus, and 1 electron revolving in the outer orbit, as we saw above. Heavy Hydrogen, which is the next isotope, has an atomic charge of 1, but an atomic mass of 2. In order to give these values its nucleus must have in it 1 proton and 1 neutron (a neutron, as its name implies, is neutral electrically but has a mass unit equal to a proton, namely 1). Helium, which is the second element in the periodic table, has a charge of 2 and a mass of 4. This means its nucleus is made up of 2 protons and 2 neutrons. Oxygen is No. 8. It has 8 protons and 8 neutrons in the nucleus to give a charge of 8 and a mass of 16, and of course has 8 electrons in the outer orbits. We could go on this way building up all the elements out of protons, neutrons and electrons (plus energy) until we had constructed all 92.

It is interesting to note that when two chemicals are placed together and a chemical reaction occurs, that the reaction is really between the outermost electrons of the two chemicals. Also, when the spectra of the different elements are produced, that it is these outermost electrons trying to get back into their original or satisfied shells or orbits that causes the spectra. For example, nearly everyone has seen a red neon sign. The characteristic color which always comes from neon is due to the fact that when the gas is excited by putting high voltage across it, that the electrons are displaced out of their normal satisfied orbits, and when they return they vibrate at such a frequency to cause this particular red glow with which we are all familiar. Also in the case of X-rays, when a high potential is applied across the X-ray tube the electrons in the target in the innermost orbits, such as No. 1 and No. 2 in Fig. 461, are displaced, and when they fly back into their satisfied orbits, X-rays are given off.

Scientists Gain Knowledge of Nucleus

During the last fifty years scientists have been experimenting, exploring and doing research work to learn all they can about atomic structure. Up until about ten years ago, in spite of the fact that the physicist had learned a great deal about the arrangement of the outermost electrons in their orbits or shells, he had not been able to

penetrate into the nucleus and to learn its secrets for several reasons. First, the size of the nucleus is so extremely small that it is very difficult to deal with. For example, the radius of the Hydrogen atom, that is the nucleus with the electron rotating around, is .00000001 cm., or, as the scientist would write it, 10^{-8} cm. However, the nucleus itself is only 10^{-13} cm. in radius, which is 100,000 times smaller than the atom. If we would represent the nucleus on a scale where its radius would be one foot, then the atom would be twenty miles in radius. Another difficulty which physicists encountered in exploring into the nucleus itself is the fact that on the nucleus there resides a positive charge which creates around it a potential barrier much stronger than any ring of steel would be. This potential barrier is impervious to acids, high pressures, or high temperatures and up until

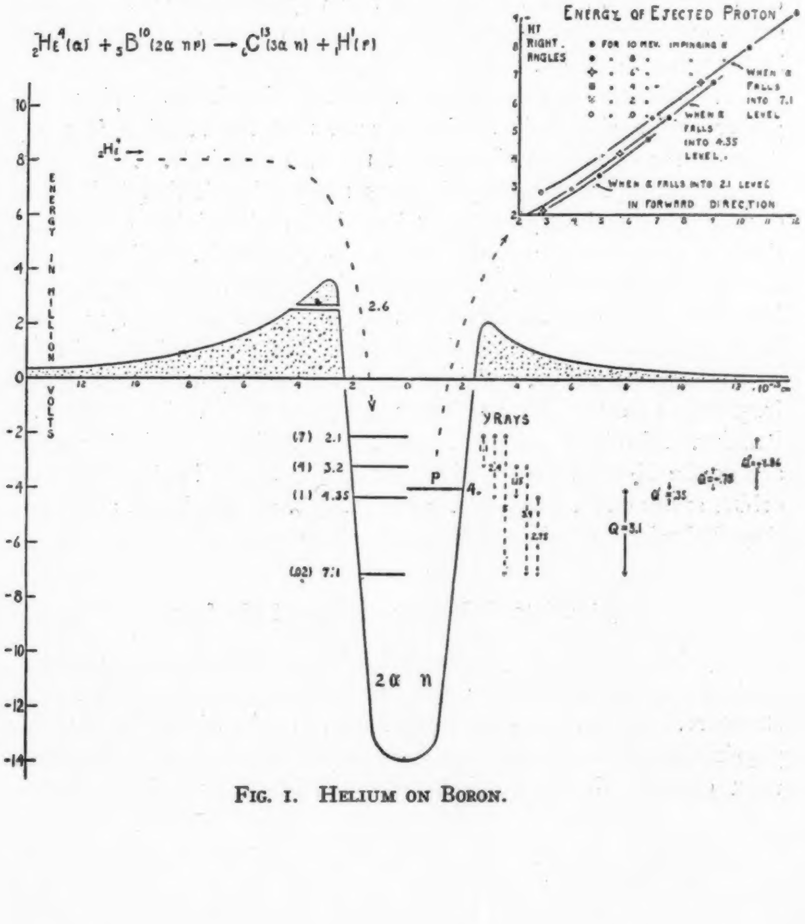

FIG. 1. HELIUM ON BORON.

1932 defied scientists' efforts to penetrate through it. We might think of this potential ring of electrical steel in another way. Around the earth there is a gravitational field which pulls objects towards the earth. If you could reverse this field so that it would throw things out, and make it many thousand times stronger than it is, then you would have a situation similar to that which exists on the nucleus. In addition, the potential barrier works in this way: the closer you get to the nucleus the greater the force pushing you away, and since we are dealing with very small distances, this force pushing away is really tremendous.

This potential barrier is shown in Fig. 2 for the case of Boron and Carbon. Along the ordinate is plotted the energy in millions of electron volts, while along the abscissa is plotted distance times 10^{-13} cm. from the center of the nucleus. In order to get across this potential barrier in the case of Boron, it is necessary for the bombarding particle to have at least 3.8 million electron volts of energy. Once over the barrier it may fall down into the various energy levels within the nucleus and cause a transmutation. In this particular case the bombarding particle is an alpha particle, which for all practical purposes may be considered to be an ionized Helium atom (that is Helium with its outer electrons stripped off). The material being bombarded is Boron. After the bombarding particle has reached the nucleus it causes a transmutation, in this case from Boron to Carbon, with the ejection of a proton with considerable energy. The nuclear reaction, like any chemical or physical reaction must balance.

$$_2He^4 + {_5B^{10}} = {_6C^{13}} + {_1H^1}$$

The subscripts represent atomic numbers and in this case each side of the equation must total 7. The superscripts represent atomic weights, and in this case each side of the equation must total 14. This is just one example of a nuclear transmutation which the Modern Alchemist is able to perform, and it is cited to show how the potential barrier surrounding the nucleus works, and how it requires tremendous energies to cause a transmutation. In this case the transmutation has been from Boron to Carbon.

Methods of Giving Bombarding Particles Large Energies

A word might be said about the various methods of giving the bombarding particles, in the above case the alpha particle, sufficient

energy so that it is able to penetrate to the nucleus. To date there are three well-recognized methods of giving the bombarding particle these tremendous energies which amount to millions of electron volts. Historically, the first method used was that of natural radioactivity. In the above case the bombarding particle, which was the ionized Helium, could have come from some natural radioactive material, such as Polonium, for it is well known now that alpha particles, which are really ionized Helium atoms, are one of the materials spontaneously and continuously shot out from the natural radioactive substances. In fact, to understand this phenomena as well as what is to come later it might be well to digress slightly and consider some of the interesting facts concerning natural radioactivity.

Natural Radioactivity

The fact that certain elements spontaneously and continuously give off certain particles and rays was discovered in 1895 by a Frenchman by the name of Becquerel, and was called by him "Radioactivity". The particles shot off are called alpha particles, beta particles, and

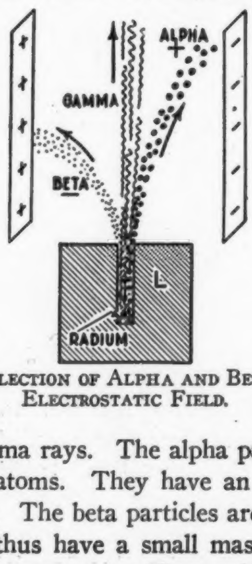

Fig. 441. Deflection of Alpha and Beta Rays in an Electrostatic Field.

the rays are called gamma rays. The alpha particles are now known to be ionized Helium atoms. They have an atomic mass of 4 and carry a positive charge. The beta particles are electrons ejected with very high speeds and thus have a small mass but carry a negative charge. The gamma rays are super X-rays, have the ability to penetrate great thicknesses of material and are generally used for the treatment of cancers, tumors, etc. Only substances with high atomic

numbers are naturally radioactive. Those having atomic numbers between 82 and 92 display this unusual characteristic. Since elements with large atomic numbers have corresponding large numbers of electrons, and large numbers of protons and neutrons in the nucleus, these elements might be thought of as being like the old lady who lived in a shoe. She had so many children she didn't know what to do. So it is with the radioactive elements, they have so many protons, neutrons and electrons, that it is hard to keep track of all of them and every once in a while one or more of them slip away. When they leave they are ejected with considerable energy and we recognize them as alpha particles, beta particles or gamma rays.

Half Life Period

Another property which is characteristic of both the natural and the artificial radioactivity, which we want to discuss later, is a property referred to as the "half life period" of the element. This is defined as the length of time for the radioactive element to lose one-half of its activity or its ability to eject particles. In the case of Uranium this is 4.5 billion years, for Radium it is 1690 years, and for Polonium it is 136 days. For the artificial radioactive substances which will be described later it is much shorter than for the naturally radioactive substances. For example the half life period of Radioactive Sodium is 14.8 hours, that of Radioactive Phosphorus is 14.5 days, Radioactive Sulphur is 60 days, while Radioactive Iron is 47 days. The shorter the half life period, the easier an element is to work with. For example, if a patient is given a dose of Radioactive Sodium, in 14.8 hours its activity has decreased to one-half. In another 14.8 hours the activity has been reduced to one-fourth, and so on. However, if Radium should be administered (which is never the case) it would take 1690 years for the activity to decrease to one-half of its original value. If this were the case the patient would hardly outlive the treatment. In the case of the natural radioactive substances, the treatment of disease is generally performed with Radon, which has a half life period of 3.8 days.

Electrostatic Generator

A second method of giving the bombarding particle sufficient energy to penetrate the potential barrier surrounding the Boron nucleus, in our example above is to use an electrostatic generator to

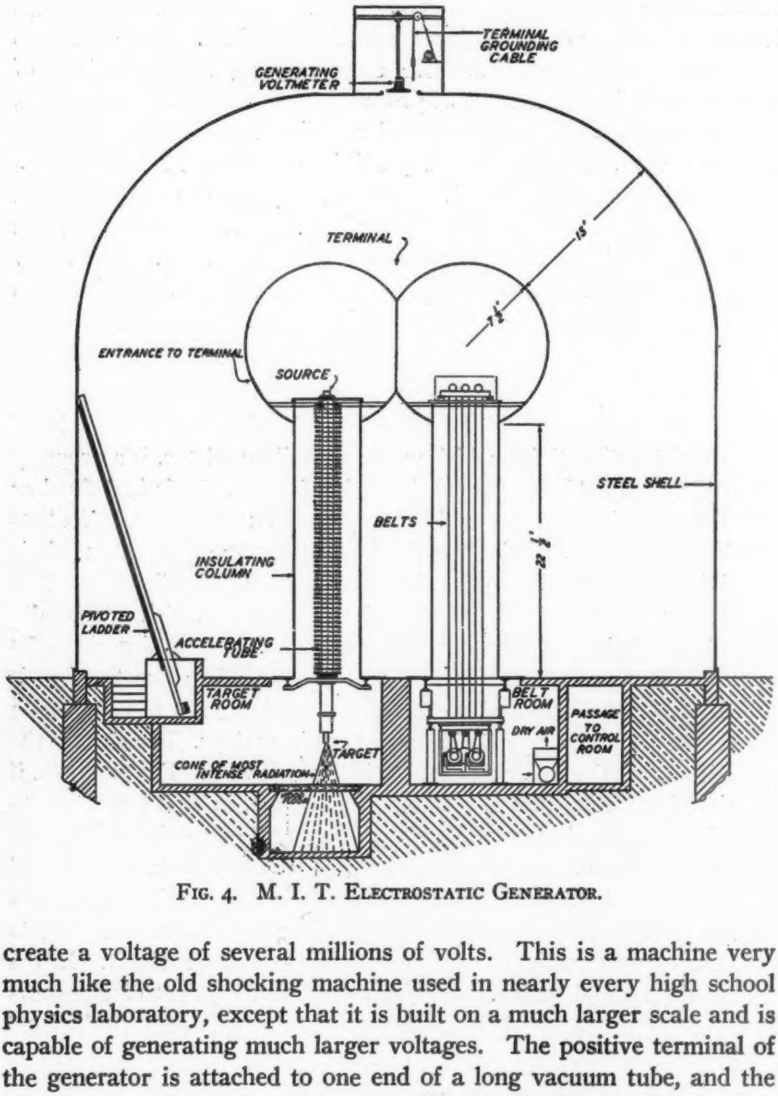

Fig. 4. M. I. T. Electrostatic Generator.

create a voltage of several millions of volts. This is a machine very much like the old shocking machine used in nearly every high school physics laboratory, except that it is built on a much larger scale and is capable of generating much larger voltages. The positive terminal of the generator is attached to one end of a long vacuum tube, and the negative terminal to the other end. The bombarding particle is then placed at the positive end and allowed to fall through this high voltage and strike the material to be bombarded which is placed on the target or negative end of the vacuum tube. Materials which are commonly

used as bombarding materials are ionized Hydrogen (Protons), ionized heavy Hydrogen (Deuterons), or ionized Helium (Alpha particles). In the case of the transmutation cited above the bombarding particles were ionized Helium. They were allowed to fall through a potential greater than 3.8 million volts, and then focused on the target, which was Boron.

The Cyclotron

There are many difficulties involved in producing and using voltages as large as one million volts or larger. In addition to the corona losses, and other forms of leakage, a more serious difficulty is the fact that by this method it is impossible to produce large currents.

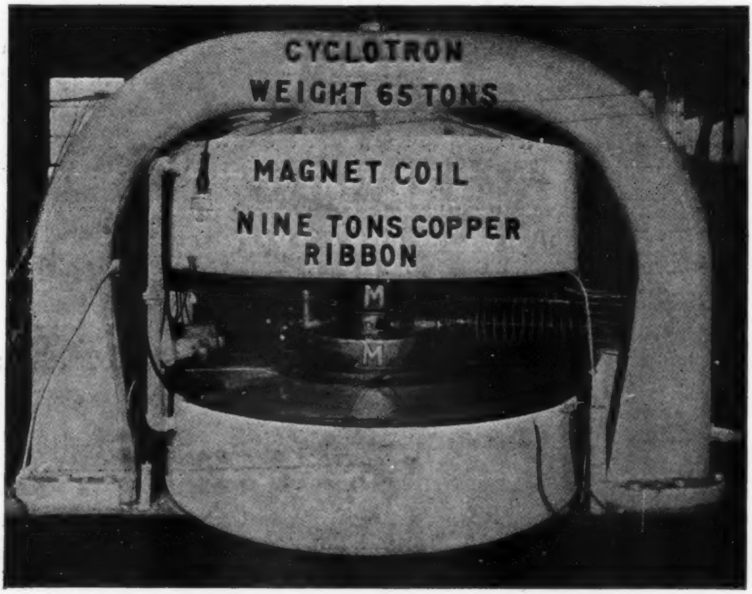

Fig. 447. University of California Cyclotron.

In 1932 a very ingenious device was constructed which not only produces large bombarding currents, but also produces large energies by the use of low voltages. This is called the "Cyclotron". It has been developed by Dr. E. O. Lawrence and his workers at the Uni-

versity of California, and is shown in Fig. 447. A vacuum chamber is suspended between the poles of two very strong electromagnets. In this chamber the ionized particle which is generally ionized Heavy Hydrogen (Deuteron), and which is going to act as the bombarding particle, oscillates between two plates or "Dees" as they are called, across which there is a voltage of between 10,000 and 50,000 volts. Each time the particle crosses between the "Dees" it picks up energy equivalent to the 10,000 volts. In many cases it passes across this potential as many as 300 times before it strikes the target. In this case the total energy would be 300 times 10,000 or 3,000,000 electron volts of energy. With the aid of this very clever device physicists have been able to produce high-voltage particles by using only low voltage, and yet able to produce large enough bombarding currents to produce copious supplies of artificial radioactive materials.

A giant cyclotron is now under construction at the University of California, which will be equivalent to literally kilograms of Radium; in fact, it is so powerful that the control room is 150 feet away from the magnet. The magnet will weigh 4,500 tons, the copper windings for the magnet will weigh 400 tons, and the diameter of the magnet will be 184 inches. With it, it will be possible to produce 100-million-volt Deuteron beams with considerable current. This is sufficient to penetrate to the nucleus of all the elements with large enough currents to produce very copious supplies of artificial radioactive materials. This work will be of inestimable value to medicine, to physiology, to biology and to science in general. It will take two more years to build this cyclotron, and the total cost will be slightly over one million dollars.

Artificial Radioactivity

With these three atomic "guns," namely, the Radioactive source, the Electrostatic generator, and the Cyclotron, the physicist in the last ten years has bombarded nearly all of the 92 elements and has found that he could transmute most of them. When an element is transmuted, or has its nucleus changed into some other state, it is generally unstable and slowly disintegrates into its original state. In so doing it ejects particles just like the naturally radioactive elements do. This is referred to as "Artificial Radioactivity". It is exactly like the natural radioactivity in that alpha particles, beta particles, and gamma rays are ejected with considerable energy, but it is differ-

ent in the fact that the "half life periods" are much shorter in the lighter elements, as pointed out above.

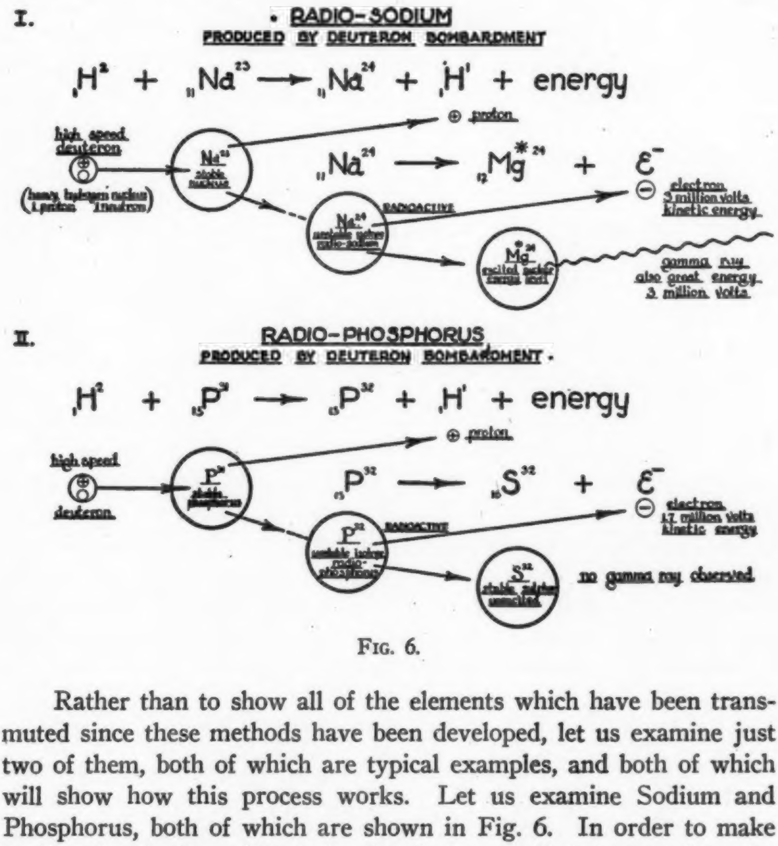

Fig. 6.

Rather than to show all of the elements which have been transmuted since these methods have been developed, let us examine just two of them, both of which are typical examples, and both of which will show how this process works. Let us examine Sodium and Phosphorus, both of which are shown in Fig. 6. In order to make Radioactive Sodium (Na is its chemical symbol) it is placed on the target of let us say the cyclotron. In this case it is bombarded with ionized heavy Hydrogen. (Symbolized by $_1H^2$. Heavy Hydrogen is an isotype of Hydrogen, sometimes referred to as the Deuteron. Radioactive Sodium ($_{11}Na^{24}$) results, with the ejection of a Proton ($_1H^1$) with considerable energy. The Radio-Sodium has a half life period of 14.8 hours and disintegrates into Magnesium ($_{11}Mg^{24}$) with the ejection of a gamma ray. The Radio-Sodium could be used then as an artificially radioactive material, with all the properties of a naturally radioactive material, except a shorter half life period.

The Nuclear reaction for the Radio-Phosphorus is somewhat the same as that of Radio-Sodium. The Phosphorus is bombarded with ionized Deuterons. Radioactive Phosphorus results ($_{15}P^{32}$) with the ejection of a proton. This material is then ready to be used in an experiment. As it is used, it disintegrates into stable Sulphur ($_{16}S^{32}$) with the ejection of an electron. A great deal of experimental work has been done with these two materials since they form so many compounds in nature.

There are a number of distinct advantages which this process of making the lighter elements artificially radioactive has to scientists which has not been possible before. In the first place, man can now make his own radioactivity, and is no longer dependent on the supplies of nature. This means that he not only can make more powerful supplies of radioactivity, but since the half life periods of the artificially produced radioactivity is much shorter, it is much easier to handle. Also most of the natural radioactive elements such as Radium, Radon, Thorium, etc., are of such a chemical nature that once they are taken into the body, they reside there permanently, either in the bones or in some organ of the body. Thus, they X-ray or gamma ray the patient to death. The maximum tolerance of the human body is about one-millionth of a gram of Radium over a lifetime. Most of the lighter elements which are made radioactive such as Sodium, Phosphorus and Sulphur can be used directly to treat tumors, cancers, etc., and then they are eliminated from the body.

Another important use of artificial radioactivity is that the activated elements can be used as "spies" or "tracers" to trace out certain chemical, biological, and physiological processes in nature which it has not been possible to study up until the present time. Let us cite an example. Scientists have never been quite sure how Phosphorus has been injected into the body. Now they can make artificially radioactive Phosphorus, which acts exactly like any ordinary Phosphorus chemically and feed a certain known dosage to a patient. As the artificially radioactive Phosphorus goes through the body it emits gamma rays which can be detected by a Geiger-Muller counter. The gamma rays might be thought of as radio waves being sent out from a sending station. They are sending out a message saying "Here I am," "Here I am now." Thus at any moment it is possible to tell exactly where each little particle of the Phosphorus is, and what it is doing.

All this goes on without disturbing the patient, without operating on him, or in any way altering his normal metabolism.

This process has been used extensively in the last ten years, to study human and animal physiological processes, to study certain chemical reactions, and more recently to study some of the processes going on in plants. Fig. No. 7 shows how the leaves of a tomato plant absorbs Phosphorus. It was made by feeding the plant Radio-Phosphorus, and then pressing the leaves against a photographic plate,

FIG. 7. LEAVES OF A TOMATO PLANT.

and allowing the ejected particles, such as gamma rays, alpha particles and beta particles to leave their trace on the photographic plate. It will be noticed that the greatest concentration of the Phosphorus is in the stems, and in certain parts of the leaves.

One more illustration of the many which have recently been reported is shown in Fig. 8. It shows the use of artificial radioactive Iodine to the study of a process which is not completely understood today, namely, the absorption of Iodine by thyroid glands. It can be

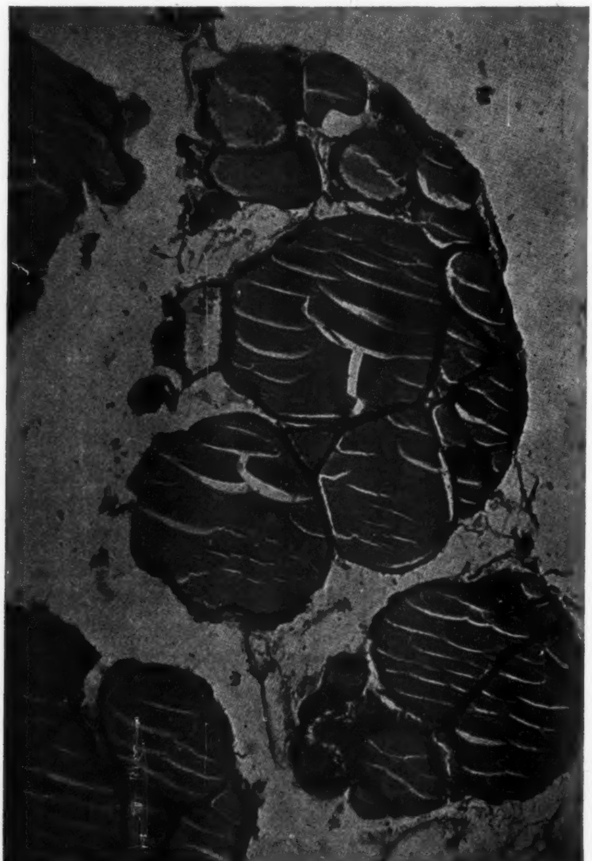

FIG. 8. THYROID GLANDS. DISPOSITION OF RADIO-ACTIVITY IODINE IN HUMAN THYROID TISSUE.

shown that if a patient is fed radioactive Iodine, that after a period of a few hours most of the Iodine has collected in the thyroid glands which are located just under the ears. This can be done by examining a patient with the aid of a Geiger-Muller counter. The counter will react when brought close to some radioactive material. The Geiger-Muller counter gives no response when brought near the patient's feet, nor near his arms, nor his stomach, but when it is brought near the thyroid glands it reacts violently, showing that the system has transported and stored most of the Radio-Iodine to these glands. Fig.

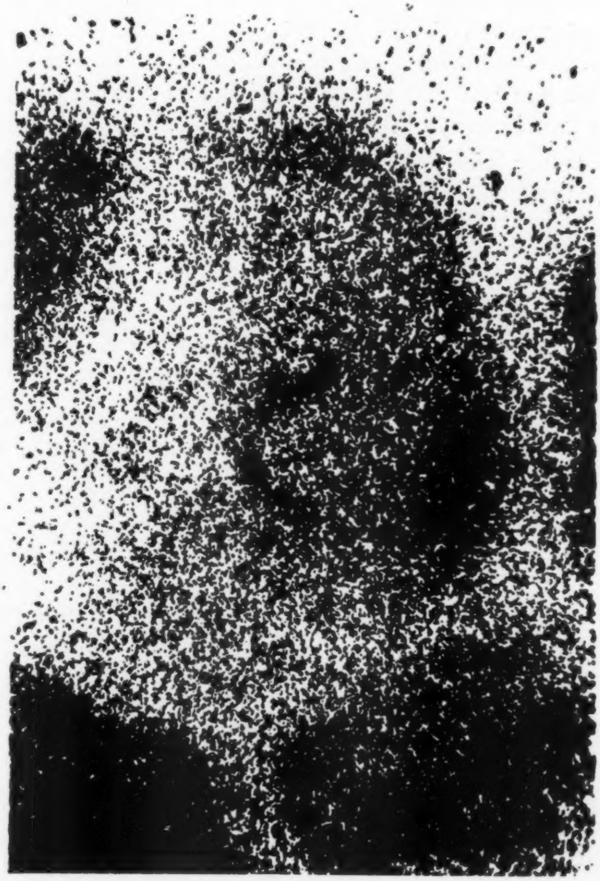

FIG. 8. THYROID GLANDS. DISPOSITION OF RADIO-ACTIVITY IODINE IN HUMAN THYROID TISSUE.

8 shows a microphotograph of a section of a thyroid gland. Next to it is the picture left by the Radio-Iodine. This shows that Iodine taken into the body tends to accumulate in the thyroid glands, and it tells the medical man just where and how it accumulates in the glands.

In conclusion, we can say that the dream of the old Alchemist has finally come true. Scientists have finally learned enough about the fundamental structure of the nucleus of the atom so that they can actually transmute one element into another. To date this has been done only in very small quantities, but in large enough quantities to prove that it can be done, and in large enough quantities to supply the research worker. The importance of this development to medicine, to science, and even to industry is inestimable at the present time, but I think you will find that the future will say, "This is a very important step forward in the history of civilization."

The author wishes to acknowledge the use of the following illustrations:

Figs. 461, 441, 447, College Physics, by Foley.

Fig. 1, Ohio Journal of Science, September, 1935.

Fig. 4, Review of Scientific Instruments, November, 1941.

Fig. 6, Ohio Journal of Science, September, 1935.

Fig. 7, Journal of Applied Physics, June, 1941.

Fig. 8, University of California Publication in Pharmacology, Vol. 1, No. 28.

PHARMACOPŒIAL NOTES

Deferment of Packaging and Labeling Requirements and Revised Formula for Elixir of Phenobarbital U. S. P. XII

The U. S. P. Committee of Revision is now giving consideration to two important proposals which it is believed will go into effect before November 1st next, when the standards of the new Pharmacopœia become official.

Packaging and Labeling Requirements—

Because of the relatively short time between the appearance of the U. S. P. XII and the enforcement date of November 1, 1942, and especially because of the many difficulties brought about by the war and the desire to avoid the loss of valuable materials and stocks of labels, bottles, and finished packages, it is proposed that the enforcement of the new packaging and labeling requirements of the U. S. P. XII shall be deferred until June 1, 1943. The most drastic of these changes are made in the new standards for Injections but many other packaging and labeling requirements have been introduced and it is believed that this will give ample time for the necessary changes and the disposal of former stocks.

Since the new U. S. P. requirements are chiefly for the purpose of adding further protection to physicians and the sick and none of the existing standards will be withdrawn, the Committee believes that no injury will come from this deferment but that it will be of material aid to manufacturers and dealers and prevent a serious loss of valuable materials.

Modified Elixir of Phenobarbital Formula—

Extensive studies of the Elixir of Phenobarbital formula have been made during the past five or more years and the new U. S. P. XII formula was believed to be a decided improvement over the original or the revised formulas of the N. F. VI.

However, since the U. S. P. XII formula requires a marked increase in glycerin, and since glycerin is a war necessity and available only in limited amounts, it is proposed to adopt for the Pharmaco-

pœia the original formula of the sixth Edition of the National Formulary for the period of the war or until the order is rescinded by official action.

The proposed formula is as follows:

ELIXIR PHENOBARBITALI

Elixir of Phenobarbital

Elix. Phenobarb.

Elixir of Phenobarbital contains, in each 100 cc., not less than 0.37 Gm. and not more than 0.42 Gm. of phenobarbital.

Phenobarbital	4 Gm.
Tincture of Sweet Orange Peel	30 cc.
Solution of Amaranth (1 percent) ..	10 cc.
Alcohol	175 cc.
Glycerin	235 cc.
Syrup	350 cc.
Distilled Water, a sufficient quantity,	
To make	1000 cc.

Dissolve the phenobarbital in the alcohol; add the tinctures, the glycerin, the syrup, and sufficient distilled water to make the product measure 1000 cc. Mix well and filter, if necessary, to make the product clear.

OUR CONTRIBUTORS THIS MONTH

Heber W. Youngken, Jr., Ph. D., is Instructor in Pharmacognosy at the College of Pharmacy of the University of Washington, Seattle. The name Youngken is not new in the annals of American Pharmacy and few, indeed, have not heard of Heber W. Youngken, Sr., one of the really outstanding American Pharmacognosists. Following in his father's footsteps, Dr. Youngken received his Ph. D. from the University of Minnesota in June, 1942, majoring in pharmacognosy and this year joined the faculty at the University of Washington.

E. B. Fischer, B. Sc., is Professor of Pharmacognosy at the University of Minnesota College of Pharmacy and is a well-known figure among botanists and pharmacognosists. Professor Fischer directed the graduate research leading to the publication of this paper by himself and Dr. Youngken.

Donald P. LeGalley, Ph. D., is Assistant Professor of Physics at the Philadelphia College of Pharmacy and Science. Dr. LeGalley did his graduate work in the Department of Physics of Pennsylvania State College and he has been keenly interested in this, one of science's most important fields, namely, nuclear physics concerning which his paper is written.

SOLID EXTRACTS

From here and there in the realm of Science

Plastics are finding ever-increasing uses, especially so nowadays in the replacement of items unobtainable because of the war. For instance, wax- and gum-dipped woven catheters formerly imported from Europe are not even missed because bone-tipped urethral catheters, made from plasticized Vinylite, have taken their place. Further, they are better than the imported articles, because they are smooth and highly polished, causing less irritation, and they may be sterilized without fear of deterioration.

Intravenous bulk solutions are administered, too, from bottles which are capped with plastic dispensing caps made from a water- and chemical-resistant phenolic material. They do not corrode and they withstand high heat and pressure, thus making sterilization easy.

AJP

It is now an established fact that calcifying elements and vitamins in the diet may aid in retarding the progress of dental caries, and, in some cases, cause its complete arrest, but the role of excess sugar in the diet as an etiologic factor is probably of prime importance.

AJP

In November, the fifth annual "Pay Your Doctor Week" will be sponsored by a bank in Los Angeles, California. Results of the four preceding observations have justified its repetition. Such a movement may become nationwide.

Trailer camps have been frowned upon from time to time, especially from the health viewpoint. However, the Farm Security Administration has established a trailer camp near Philadelphia that seems to be a model insofar as health precautions are concerned. It consists of 497 trailers housing 1822 people. Of this number 1103 are adults and 719 are children. 475 trailers are for family use, five are for laundries, 13 for toilet and bath, and one for the isolation of minor diseases. Garbage is collected twice a week and incinerated. Rubbish is collected three times a week, from specially designed individual storage barrels. Each trailer has its own French drain. All children are immunized against diphtheria and smallpox.

AJP

Medical statistics reveal that the delivery of twins eventuates in one out of every 87 births. Triplets occur once out of every 7,103 births while quadruplets occur only once in 747,000 blessed events. The chance of having quintuplets is merely one in 41,600,000.

AJP

In two months during the summer just completed, Pennsylvania's Health Department destroyed 116½ acres of marihuana, or about 21,020 pounds. Eradication of this menace should be one of the prime objectives of every such department.

BOOK REVIEWS

Two New Volumes Are Brought to Your Attention

Formulary for Use in Military Hospitals 1942. Published by His Majesty's Stationery Office, London. Available from British Information Services, 30 Rockefeller Plaza, New York. Price 5¢.

This very brief little booklet (37 pages) is primarily intended as a guide to medical and dental officers for prescriptions written for patients in the military hospitals. Included are some formulas for various relatively simple preparations, some of them considerably obsolete in modern practice. This is, of course, no evidence of lack of modern therapeutics in military hospitals but many of the formulas included do not represent your reviewer's concept of modern practice. Some additional information is briefly presented such as, for example, a correlation of proprietary and non-proprietary titles and some of the more commonly required antidotes.

L. F. Tice.

Textbook of Bacteriology. By Thurman B. Rice, A. M., M. D., Professor of Bacteriology and Public Health, Indiana University School of Medicine. Third edition, revised. 560 pages. W. B. Saunders Company, Philadelphia and London. Price $5.00.

The present third edition is identical in size (number of pages) and contains practically the same title headings for the 57 chapters and the appendix as are found in the second edition. The author presents this new edition "to serve as a practical rather than as a theoretical text-book" and states that "it is expected that the instructor will lecture on the more highly theoretical phases of the subject;" yet he falls into the error of leaving out much of practical value. Furthermore, he includes many detais either of theories or of techniques never to be used by those for whom this volume is intended; and certainly if so intended by the author, not sufficiently detailed for them to gain much from the presentations. Obviously, it is not possible in a brief review to note all of the above. However, it may be sufficient to observe that 118 pages (399-517) are given over to immunity and immunological considerations, where a large portion of the material is theoretical. More space could have been advantageously spent on

practical considerations in heat sterilization and the use of disinfectants. It is difficult to understand why today, in a *practical* volume as intended, the efficiency of the sulfonamide compounds is not considered, even briefly. The author states this should "be left for classes in clinical medicine," (p. 91) a course not given to some of those for whom this volume is intended (see preface). Furthermore, he speaks of sulfanilamide as a "relatively little known drug" (p. 173), though article after article appeared in the literature in this country for five years prior to the appearance of this text.

Much could be said about leaving out useful information concerning each of the organisms considered, which is of *practical* value. For instance, it is generally accepted today that coagulase—positive strains of staphylococci are pathogenic and the fibrinolytic activity of hemalytic streptococci are of special interest. Nowhere in this volume are these facts mentioned. Furthermore, under staphylococci we are told that food poisoning "may be due to staphylococcus," (p. 124), but it is not pointed out that this is due to a gastro-enterotoxic action, effective *only upon ingestion.* Under streptococci, we learn that "By this classification (serological), the hemolytic streptococci are divided into some 9 or 10 groups designated by letters of the alphabet" (p. 132). Literature abounds with the designation of the latter as the Lancefield classification or grouping and the precipitin classification, but one reading the latter in articles or noting the terms enterococcus or indifferent streptococci could not be able to learn what these mean, if this new edition only is consulted. Under many of the other organisms, similar and other valuable practical facts are not given.

Under yellow fever, nothing is said about prophylactic immunizing procedures (p. 343). Under typhus fever, the statement is made: "There are no specific products which can be used in prevention" (p. 332). In both instances, everyone is aware today that our military personnel is receiving prophylactic injections against these two diseases, and the military personnel in other countries have been receiving them for quite some time prior to the appearance of this volume.

It appears to this reviewer that the new edition falls short of the actual purpose intended, though as a volume of general bacteriological information, it can serve a useful purpose, as have the previous editions.

Louis Gershenfeld.

THESE CHANGING TIMES

THIS IS OCTOBER, 1942. There is a war . . . a war that sinks its vicious fangs into most of the civilized world . . . a war of unprecedented portent . . . a war of actual survival.

This is a changed America . . . automobile traffic is light . . . cars stand idle in garages on Sunday . . . attics are searched for scrap . . . factories pulsate day and night under the strain of wartime production.

Even the drug business has changed . . . many commodities are short . . . deliveries have been curtailed or discontinued . . . taxes bite deep into the day's receipts . . . some of the boys from the store are now in uniform.

Changed is our system of American economy . . . changed is our way of life . . . changed are our habits of thinking . . . changed is the pattern of drug-store operation . . . changed are the affairs of the world . . . and the end is not yet.

One of the notable exceptions is the Lilly Policy. There has been no change in that. Despite the abnormal demand which taxes manufacturing facilities, Lilly Products are still sold at a uniform price to all pharmacists alike through the recognized distributor of the buyer's choice.

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